NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DEEP TILLAGE

(Ac.)

CODE 324

Subsoiler on Cropland

DEFINITION

Performing tillage operations below the normal tillage depth to modify adverse physical or chemical properties of a soil.

PURPOSE

This practice supports one or more of the following purposes:

- Bury or mix soil deposits from wind or water erosion or flood overwash – Resource concern (DEGRADED PLANT CONDITION – Undesirable plant productivity and health).
- Fracture restrictive soil layers – Resource concern (SOIL QUALITY DEGRADATION – Compaction).

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land having adverse soil conditions which inhibit plant growth, such as compacted layers formed by field operations, restrictive layers such as cemented hardpans (duripan) in the root zone, overwash or deposits from wind and water erosion or flooding.

This practice does not apply to normal field operations and tillage methods for planned crop production.

CRITERIA

General Criteria Applicable to All Purposes

This practice has the potential to convert (by draining) or degrade wetlands. Therefore, impacts to existing wetland functions need to be assessed. USDA Food Security Act Wetland Conservation Provisions apply. This practice must comply with NRCS wetland technical assistance policy contained in the General Manual, Title 190, Part 410.26.

Avoid or minimize to the extent practical impact to cultural resources, wetlands, and Federal and State protected species during planning, design and implementation of this conservation practice. For more information, see National and Florida NRCS policy, General Manual (GM) Title 420-Part 401, Title 450-Part 401, and Title 190-Parts 410.22 and 410.26; National Planning Procedures Handbook (NPPH, Handbooks Title 180 Part 600) FL Supplements to Parts 600.1 and 600.6; National Cultural Resources Procedures Handbook (NCRPH, Handbooks Title 190 Part 601); and The National Environmental Compliance Handbook (NECH, Handbooks Title 180 Part 610).

Perform deep tillage operations when soil moisture, at the maximum depth to which the tillage will be done, is less than 30-50 percent of field capacity according to the “feel test” or other acceptable method.

Additional Criteria to Fracture Restrictive Soil Layers

Use tillage equipment such as chisels, subsoilers, bent-leg subsoilers, or rippers, with the ability to reach the required depth to fracture the restrictive layer.

Operate deep tillage to fracture restrictive layers to a minimal depth of 1" below the bottom of the restrictive layer.

The horizontal extent of the fractured layer needs to, at a minimum, be sufficient to permit root penetration below the restrictive soil layer.

When deep tillage is needed for areas to be planted with trees or shrubs, the deep tillage operation needs to be performed approximately 3 to 4 months prior to planting to allow time for rainfall to settle the soil and fill air pockets. Transplant seedlings within the deep tilled area.

Additional Criteria to Bury or Mix Soil Deposits from Wind and Water Erosion or Flood Overwash

Selection of equipment and depth of deep tillage operation is based on the need to invert and mix soil deposits to a depth required to meet planning objectives. At a minimum, invert and mix soil deposits 2 times (2X) the depth of the deposited material.

CONSIDERATIONS

Where restrictive layers are a concern, the effects of this practice can be enhanced by including deep rooted crops in the rotation that are able to extend to and penetrate the restrictive layer.

Reduce or control equipment traffic during periods when soils are prone to compaction and formation of tillage pans. Extra caution should when excessively heavy equipment is used at any time to ensure that soils are not prone to compaction. Loads greater than 6 tons/axle have been found to cause compaction to depths of approximately 16 inches which is below normal depths of tillage and may cause yield reductions for several years.

Reducing contact pressure between the load and the soil may also be helpful to reduce recompaction. Typical bias-ply tires require excessive inflation pressures which can concentrate the loads on the soil surface and cause excessive soil compaction. Radial tires offer superior soil

compaction and traction characteristics when properly inflated to the manufacturer's specifications. Other methods that can be used to further spread the load and potentially reduce soil recompaction include using dual tires or tracks beneath tractors, grain wagons, slurry tanks, etc.

Research on numerous crops has shown that tillage conducted excessively deeper than the compacted layer does not promote increased yields, requires excessive amounts of tillage energy, and promotes future compaction from nearby vehicle traffic.

To help reduce development of compacted restrictive layers, conduct normal tillage operations when soil moisture is less than 50 percent of field capacity. When possible, harvest operations should be avoided when soil moisture is greater than 50 percent of field capacity. Limit field harvest haul traffic to end rows or haul roads. Compacted regions between crop rows that are not fractured can assist in supporting vehicle traffic, limiting rutting, and soil compaction beneath the row.

When infertile flood overwash is mixed with the pre-flood soil profile, the soil rebuilding process can be enhanced by additions of organic matter, such as manure or cover crops utilized as green manure. Crop rotations, tillage and planting systems, which maintain high levels of crop residues, such as no-till, can also accelerate this process. See Florida NRCS Conservation Practice Standards (CPS) Cover Crop, Code 340; Conservation Crop Rotation, Code 328; and Residue and Tillage Management Practices, Codes 329 and Code 345, for further guidance.

Where the flood overwash layer is too thick to effectively mix with the pre-flood soil profile, redistribution of the overwash layer by smoothing or removal may be necessary. Generally, no more than about 6 inches of overwash can be uniformly mixed into the soil profile using commonly available equipment. Specialized equipment may be necessary where greater depths of overwash are to be incorporated.

Do not use this practice where unfavorable soil materials such as high sodium, calcium, gypsum or other undesirable materials, are within anticipated deep tillage depth and would be brought to the surface by deep tillage operations.

Transport of sediment-borne pollutant(s) offsite can be reduced when this practice is used in a conservation management system, by reducing the concentration of pollutants in the surface layer.

Moldboard plows and large tandem disks, when used to bury and mix soil deposits, can have a destructive effect on soil physical characteristics. These implements create conditions ideal for soil compaction to occur. Chisels with twisted points have a slightly less destructive impact.

Disruption of the soil surface is not desired and should be minimized where possible through proper selection of shanks. Excessive disturbance of the soil surface can cover plant residues which should be maintained on the soil surface to intercept rainfall and impede surface runoff.

Approximately 30 horsepower per subsoil shank is required in Southern Coastal Plain and Atlantic Coast Flatwoods soils. Heavily eroded soils, critical areas, and soils with higher clay content may require more horsepower. Bent-leg subsoilers require even more horsepower.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the selected conservation practice purposes, criteria and conditions, and considerations in this CPS.

At a minimum, record the following information using approved Implementation Requirements document.

1. Site Information
    a. Acres
    b. Soil Texture
    c. Soil Moisture (at time of deep tilling)
    d. Slope (%)
    e. Depth to Restrictive Layer
    f. Depth of Soil Deposit (if applicable)
2. Tillage Information
    a. Equipment Used
    b. Depth of Tillage
    c. Chisel Point Spacing (in)
    d. Date/Timing of Tillage

OPERATION AND MAINTENANCE

Evaluate effectiveness of deep tillage field operations applied for fracturing restrictive layers or mixing soil deposits and adjust plan if needed and reapply deep tillage when these field conditions reoccur.

REFERENCES

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Reeder, R. and D. Westermann. 2006. Soil management practices. p. 63. In M. Schnepf and C. Cox (ed.) Environmental benefits of conservation on cropland: The status of our knowledge. Soil and Water Conservation Society, Ankeny, IA.

USDA, NRCS. 1996. Soil Quality Information Sheet: Sediment deposition on cropland.